THEORY OF COMPUTATION

(Regular Languages, Finite Automata, Regular Expressions)

1. A minimal DFA accepting the language $L = \{w/w \in (0,1)^*\}$, the number of a's, b's and c's in w are divisible by 2, 3 and 4 respectively has _____ number of states

2. Consider the language $L_1 = \{a^p \cdot b^q \cdot c^r \mid p, q, r > 0\}$ and $L_2 = \{a^p \cdot b^q \cdot c^r \mid p, q, r \geq 0 \text{ and } p = r\}$, then which of the following statements are true.

(1) $L_1 \cup L_2$ is a context free language
(2) $L_1 \cap L_2$ is a context free language
(3) $L_1 - L_2$ is not regular
(4) L_1 and L_2 both are regular languages

(a) Only 1 and 2 statements are true
(b) Only 3 and 4 statements are true
(c) Only 1, 2, 3 statements are true
(d) Only 1, 2, 4 statements are true

3. Find the number of states in minimal finite automata which accepts a language of strings whose length divisible by both '5' and '2' over $\Sigma = \{0, 1\}$

4. Find minimized finite automata which recognizes the below languages, separately by m_1 and m_2 over binary strings as input, then find the number of states in each of the following.

L_1:L_2 is a language, which contains a set of strings which produces a remainder '1', when its equivalent value is divisible by '4'.

L_2:L_1 is a language it contains a set of strings which are starting with 1010 and the length of the string is divisible by 4.

(a) m_1 contains 4 states and m_2 contains 7 states
(b) m_1 contains 4 states and m_2 contains 8 states
(c) m_1 contains 3 states and m_2 contains 9 states
(d) m_1 contains 4 states and m_2 contains 9 states

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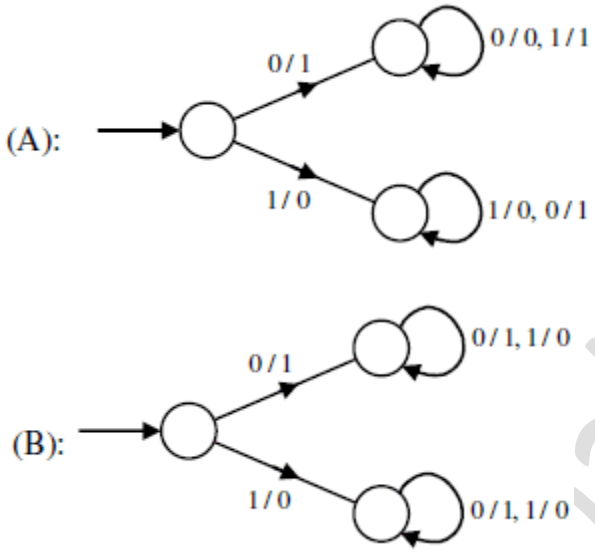
5. Construct a minimal finite automata for the language 'L', it contains a set of strings, which are having two consecutive 0's and the number of 0's in the same string is divisible by '2'.

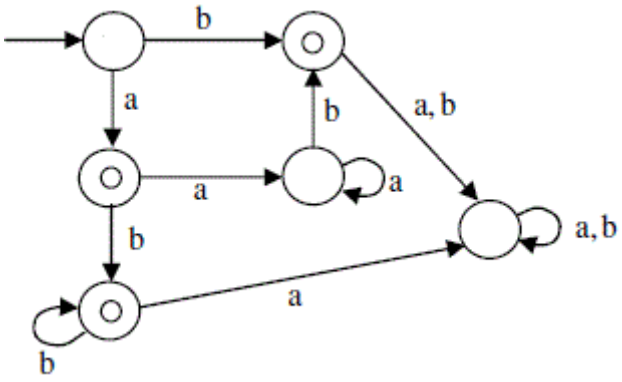
6. Consider the following two machines A and B. Suppose that an input string is processed on A and then the output string is immediately fed into B (as Input) 2 processed only this second resultant output is considered that the final output of AB. If the output string is same as the original input string, we say that AB has identity property symbolically written (A) (B) = identity



Which of the following is correct?

(a) (A) (B) = (B) (A)
(b) (B) is inverse machine of (A)
(c) (A) is inverse machine of (B)
(d) All are true

7. The language accepted by below automata is



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(a) $L = \{a^x bb^x \mid x \geq 0\}$
(b) $L = \{a^x b \cup b \mid x \geq 0\}$
(c) $L = \{a^x b^x \cup b \mid x \geq 0\}$
(d) $L = \{a^x b \cup ab^x \mid x \geq 0\}$

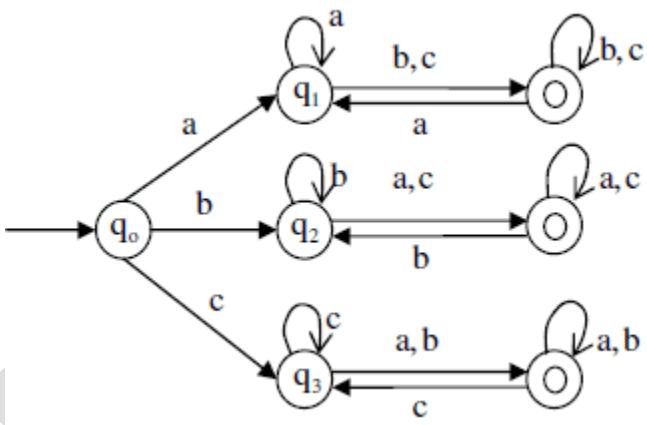
8. Consider the language defined by the regular expression (a | b) * b^+.

Which of the following regular expressions also define that language?

(i) (a*b^+) | (b*b^+)
(ii) (ab |bb)*b*
(iii) (a | b | ba)*b^+

(a) i only
(b) i & ii only
(c) iii only
(d) All of these

9. Find the Regular expression for the following F.A.



(a) $(a + b + c) \cdot (a + b + c)^*((a + c)^* + (b + c)^* + (a + b)^*)$
(b) $(a^* + b^* + c^*) \cdot ((bc)^* + (ac)^* + (ab)^*)$
(c) $(a^+(a + b + c)^* \cdot ((b + c)^*) + (b^+ \cdot (a + b + c)^* \cdot (a + c)^*) + (c^+ \cdot (a + b + c)^* \cdot (a + b)^*)$
(d) $(a^+\big((b + c)a\big)^* \cdot (b + c^+) + \big(b^+ \cdot \big((a + c)b\big)^* \cdot (a + c)^*\big) + \big(c^+ \cdot \big((a + b) \cdot c\big)^* \cdot (a + b)^+\big)$

10. Below is the grammar then find the language generated by given grammar

S → ABC	Xb → bx
AB → aAx |bAy | ∈	Ya → ay
C → ∈	Yb → by

$XC \rightarrow BaC$ $\quad aB \rightarrow Ba$

$YC \rightarrow BbC$ $\quad bB \rightarrow Bb$

$Xa \rightarrow aX$

(a) $L = \{w | w \in (a, b)^*, \text{and } x_a(w) = x_b(w)\}$

(b) $L = \{w | w \subseteq (a, b)^+, \text{and w is a palandrom string}$

(c) $L = \{w | w \subseteq (a, b)^*, \text{and } w = xx, \text{where } X = (a, b)^*\}$

(d) None of the above

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